UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/748,829	12/29/2003	Weidong Yang	NAN066 US	7169

34036 7590 04/25/2008

Silicon Valley Patent Group LLP
18805 Cox Avenue
Suite 220
Saratoga, CA 95070

EXAMINER	
ROSARIO, DENNIS	
ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
04/25/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/748,829	YANG ET AL.	
	Examiner	Art Unit	
	Dennis Rosario	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 March 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *23-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *23-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/24/08 has been entered.

Response to Amendment

2. The amendment was received on 3/24/08. Claims 23-39 are pending.

Response to Arguments

3. Applicant's arguments on pages 9-12 filed 3/24/08 have been fully considered but they are not persuasive.

Regarding page 9, applicants state that Nikoonahad does not disclose correcting the determined measurement of the overlay error using detected radiation from at least one pair of the measurement locations from the overlay pattern.

The examiner respectfully disagrees since Nikoonahad teaches that the prior art results in an error of the overlay error due to vibrations and presents a solution to correct the overlay error due to vibrations as discussed in col. 2, lines 21-58 wherein the solution includes using a wider focus range to capture at least two measurement locations at different elevations of an overlay pattern using a light detection device.

Applicants state that Nikoonahad does not teach local process variations.

The examiner respectfully disagrees since a local process variation is clearly shown in fig. 6A, 24(2) relative to 24(1) where 24(2) was created at a different elevation relative to 24(1).

Regarding page 10, applicants state that Raymond has no disclosure of correcting the determined measurement of the overlay error for local process variations.

The examiner respectfully disagrees since Raymond does correct, via fig. 17, the determined measurement, as shown in fig. 15 as S Data, of the overlay error of fig. 15 for local process variations as shown in fig. 15 that shows an overlay pattern with an overset of -50 nm. The overlay pattern with the offset of -50 nm is a local process variation, because the offset is describing a local offset or variation of corresponding upper and lower layers of the pattern from a reference offset of 0 nm within the overlay pattern.

Regarding page 10, applicants state that Raymond does not teach correcting (via fig. 17) the determined measurement of the overlay error (fig. 15: -50 nm is the overlay error) for effects (such as isomerism as shown in fig. 15 that can not be distinguished from each other as S Data in fig. 15 indicates) of the local process variations (or -50 nm that describes a local offset of grating structures) created during processing of the overlay pattern using the detected radiation (or light) from at least one pair of the measurement locations (since an overlay pattern already includes a pair of measurement location such as a top and bottom layer of the overlay pattern) from the overlay pattern.

Regarding page 10, applicants state that Stirton does not correct the determined measurement of the overlay error using detected radiation from at least one pair of measurement locations from the overlay pattern.

The examiner respectfully disagrees since Stirton does correct the determined overlay error corresponding to "a reduction in the overlay error" in col. 11, lines 11-13 using detected radiation, in order to find the overlay error for reduction in error of the overlay error represented in figures 4A-4C that shows an "Intensity" axis that represents the detected radiation such as the two arrows in fig. 3B directed to 134, from an imager from at least one pair of measurement locations as shown in fig. 3B, numerals 208 and 210 and represented by said two arrows directed to 134 of fig. 3B from the overlay pattern, fig. 2A, num. 200.

Regarding page 11, applicant states that Mieher does not discuss local process variations, i.e., differences in measurement locations within the same overlay pattern.

The examiner respectfully disagrees since Mieher discusses a pattern 902 as shown in fig. 9A that is "on the substrate" and is "distinct" in [0219] since Mieher teaches a pattern on top of a substrate, Mieher is teaching an overlay pattern with different measurement locations since each of said 902 is spatially distinct and "widely varied" in [0221].

Regarding page 12, applicants state that Mieher does not disclose correcting the determined measurement of the overlay error for effects of the local process variations.

The examiner respectfully disagrees since Mieher discloses a method to "improve the measurement precision [of overlay error or overlay]" in [0133] by considering "film effects" in [0133] from "variation in…film thickness" in [0222] "one target at a time" in [0222] to "eliminate[e] [that] effect" in [0222] of the variation of film thickness. Thus, the above passages mean when using the method to improve the overlay error, the method is based on measuring one of fig. 9A, num. 902 that is constructed with a local variation in film thickness the effect of which is eliminated from measurement of the overlay using said method that improves the overlay error measurement of one of said 902 by eliminating or separating various film thicknesses effects.

Regarding page 12, applicants state that Mieher does not disclose correcting the determined measurement of the overlay error using the detected radiation from at least one pair of the measurement locations from the overlay pattern.

The examiner respectfully disagrees since Mieher broadly discloses correcting the determined measurement of the overlay as discussed above via the film effects to improve the overlay measurement using radiation or light detected from a CCD from one pair of the measurement locations from the overlay pattern since an overlay pattern already has overlapping layers; hence the name overlay pattern that is understood to have a pair of measurement location due to the layered structure of the overlay pattern.

Note that after reviewing and responding to the remarks, the examiner concluded that the claimed "local process variation" is broad enough to maintain the various rejections and suggests further limiting the claimed "local process variations" of the independent claims, as new dependent claim 37 similarly does, to at least eliminate the current broad interpretations of the claimed "local process variations."

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 23, 24 and 33 are rejected under 35 U.S.C. 102(e) as being anticipated by Nikoonahad et al. (US Patent 7,009,704 B1).

Regarding claim 23, Nikoonahad discloses a method comprising:

a) providing an overlay pattern (fig. 9) having a plurality of measurement locations, each measurement location includes a bottom diffraction grating (fig. 9,num. 132) and a top diffracting grating (fig. 9,num. 136) that overlies the bottom diffraction grating and has a designed in offset (or "different pitch" in col. 11, line 67) from the bottom diffraction grating, wherein at least two measurement locations (or layers) in the overlay pattern differ from each other (due to the offset) at least partially due to local process variations (since the offset is a design parameter) created during processing of the overlay pattern;

b) illuminating (fig. 1: Illumination) each of the plurality of measurement locations of the overlay pattern with incident radiation that reacts with the diffraction gratings;

c) detecting (fig. 1,num. 32) the radiation from the measurement locations after reacting with the diffraction gratings;

d) determining a measurement (as the prior art teaches) of an overlay error (via fig. 8,num. 18) between the bottom diffraction gratings and the top diffraction gratings using the detected radiation (or light) from the measurement locations (or layers) from the overlay pattern; and

e) correcting (via the teaching of Nikoonahad) the determined measurement (from the prior art) of the overlay error (or "correct any errors" in col. 16, line 3) for effects (from vibrations such as blurring of an image) of the local process variations (or said offsets of jagged edges that needs to be captured without blurring) created during processing of the overlay pattern (since said offsets is a design parameter) using the detected radiation (or light detected from a camera that needs to focus to captured the jagged edges without blur which is an effect of vibration) from at least one pair of the measurement locations (or layers of an overlay pattern) from the overlay pattern.

Regarding claim 33, claim 33 is rejected the same as claim 23 except for the additional limitation as discloses in Nikoonahad of a method comprising:

a) providing an overlay patten (fig. 6A,num. 34) having at least four measurement locations (one of which is indicted by an arrow pointing to 34 that can points to other areas of 34), each measurement location having a bottom diffraction grating (fig. 6A,num. 24(1)) and a top diffracting grating (fig. 6(A), num. 24(2)) that overlies the bottom diffraction grating and has a designed in offset (as shown in fig. 6A) from the bottom diffraction grating, at least two pairs of the measurement locations have the same magnitude designed in offset (or "same settings for pitch" in col. 11, line 65).

Regarding claim 24, claim 24 is rejected the same as claim 23 except for the additional limitation as disclosed in Nikoonahad of further comprising:

a) providing the overlay pattern (or "wafer: in col. 15, line61) having the plurality of measurement locations prior (during a "remov[al] in col. 15, line 63 process) to depositing the top diffraction gratings (or "photoresist" in col. 15, line 60) over the bottom diffraction gratings, such that the overlay pattern is incomplete and each measurement location of the incomplete overlay pattern has a bottom diffraction grating.

6. Claims 33 and 34 are rejected under 35 U.S.C. 102(e) as being anticipated by Raymond (US Patent 6,856,408 B2).

Regarding claim 33, Raymond discloses of a method comprising:

a) providing an overlay pattern (fig. 1: Film layers) having at least four measurement locations (one of which is indicted by an arrow pointing to Film layers that can points to other areas of Film layers), each measurement location having a bottom diffraction grating (or bottom portion of Film layers) and a top diffraction grating (fig. 1: Patterned (periodic) features) that overlies the bottom diffraction grating and has a designed in offset (fig. 14:offset) from the bottom diffraction grating, at least two pairs (as shown on the right side of fig. 15) of the measurement locations have the same magnitude (fig. 15: offset=-50nm and offset=50nm) designed in offset wherein at least two measurement locations (or layers) in the overlay pattern differ from each other (because the layers are at different elevations) at least partially due to local process variations (since the top layer is local or touching or adjacent relative to the bottom layer and are varied or different because the layers are at different or various elevations) created during processing of the overly pattern;

b) illuminating (fig. 1:Input laser beam) each of the measurement locations of the overlay pattern with incident radiation that reacts with the diffraction gratings;

c) detecting (fig. 1:Detector) the radiation from the measurement locations after reacting with the diffraction gratings;

d) determining a measurement (fig. 15) of an overlay error (since fig. 15 is a pattern or image used to determine an overlay error of an actual structure) between the bottom diffraction gratings and the top diffraction gratings using the detected radiation (or light) from the measurement locations (or layers); and

e) correcting (via fig. 17) the determined measurement (fig. 15) of the overlay error for effects (such as aliasing as show in fig. 15 of identical but opposite structures in fig. 15)) of the local process variations (said layers at different elevations) created during processing of the overlay pattern using the detected radiation from at least one pair of the measurement locations from the overlay pattern.

Regarding claim 34, Raymond discloses the method of Claim 33, wherein at least two of the measurement locations have the same magnitude designed in offset in opposite directions (as discussed above with respect to fig. 15: offset) and at least two measurement locations have the same magnitude designed in offset in the same direction (as indicated in fig. 15: Angle Number that indicates a single angle for both measurement locations).

7. Claims 23-33,35-39 are rejected under 35 U.S.C. 102(e) as being anticipated by Mieher et al. (US Patent Application Publication No.: 2004/0169861 A1).

Regarding claim 33, Mieher discloses of a method comprising:

a) providing an overlay pattern (fig. 2(a)-(f)) having at least four measurement locations (as indicated in fig. 3(a), numerals 302(a)-302(d)), each measurement location having a bottom diffraction grating and a top diffraction grating that overlies the bottom diffraction grating and has a designed in offset from the bottom diffraction grating (all of which is shown in figs. 2(a)-2(f)), at least two pairs of the measurement locations have the same magnitude designed in offset (fig. 2(a) has offset +F and fig. 2(b) has offset –F) wherein at least two measurement locations (or layers) in the overlay pattern differ from each other (since the layers are at different elevations) at least partially due to local process variations (since said layers at different elevations is a local process variation) created during processing of the overlay pattern;

b) illuminating (via fig. 4,num. 402) each of the measurement locations of the overlay pattern with incident radiation that reacts with the diffraction gratings;

c) detecting (fig. 4,num. 412) the radiation from the measurement locations after reacting with the diffraction gratings;

d) determining a measurement (via a "combination of scatterometers" in [0133] the method of which is to increase the accuracy of the measurements) of an overlay error (fig. 3(a), num. 308) between the bottom diffraction gratings and the top diffraction gratings using the detected radiation from the measurement locations; and

e) correcting (via said combined scatterometers) the determined measurement of the overlay error (or "corrections…of the errors" in paragraph [0070], last sentence) for effects (such as the effect of film thickness which can be height due to the film being too thick or too thin) of local process variations (such as local layers at different elevations) created during processing of the overlay pattern using the detected radiation from at least one pair of the measurement locations from the overlay pattern.

Regarding claim 35, Mieher discloses the method of Claim 33, wherein a first pair (fig. 3(a), numerals 302a and 302b) of the measurement locations have a first magnitude designed in offset (+F+f0 in num. 302a and –F+f0 in num. 302b) in opposite directions and a second pair (fig. 3(a), numerals 302c and 302d) of the measurement locations have a second magnitude designed in offset in opposite directions (+F-f0 in num. 302c and –F-f0), wherein the first magnitude (said +F+f0) is different (via +/-sign) than the second magnitude (+F-f0).

Regarding claim 36, Mieher discloses the method of Claim 33, wherein correcting the determined overlay error for effects of local process variations created during processing of the overlay pattern is performed while determining the overlay error (since the correcting of Mieher is done to during the step of "refine the determination of the overlay E" in [0070], last sentence).

Claim 23 is rejected the same as claim 33. Thus, argument similar to that presented above for claim 33 is equally applicable to claim 23.

Regarding claim 24, claim 24 is rejected the same as claim 23 except for the additional limitation as disclosed in Mieher of further comprising:

a) providing the overlay pattern having the plurality of measurement locations prior to depositing the top diffraction gratings over the bottom diffraction gratings (or "partial…layer" in [0065]), such that the overlay pattern is incomplete and each measurement location of the incomplete overlay pattern has a bottom diffraction grating.

Regarding claim 25, Mieher discloses the method of Claim 24, wherein using the detected radiation from the measurement locations of the incomplete overlay pattern and the detected radiation from the measurement locations of the completed overlay pattern to determine the overlay error comprises:

a) generating a plurality of ratios (as shown in [0064]) of differential spectra from measurement locations of the incomplete overlay pattern;

b) generating a plurality of differential spectra (as shown in [0064]) from measurement locations of the completed overlay pattern;

c) using said plurality of ratios and said plurality of differential spectra to determine the overlay error ("determine overlay" in [0065]).

Regarding claim 26, Mieher discloses the method of Claim 25 wherein using said plurality of ratios and said plurality of differential spectra comprises:

a) directly solving for the overlay error (via said equation in [0064]) based on said plurality of ratios and said plurality of differential spectra.

Regarding claim 27, Mieher discloses the method of Claim 25, wherein using said plurality of ratios and said plurality of differential spectra comprises:

a) curve fitting (fig. 3(b): Linear approximation).

Claim 28 is rejected the same as claim 36. Thus, argument similar to that presented above for claim 36 is equally applicable to claim 28.

Claim 29 is rejected the same as claim 33. Thus, argument similar to that presented above for claim 33 is equally applicable to claim 29.

Claims 30 and 32 are rejected the same as claim 35. Thus, argument similar to that presented above for claim 35 is equally applicable to claims 30 and 32.

Claim 31 is rejected the same as claim 30. Thus, argument similar to that presented above for claim 30 is equally applicable to claim 31.

Regarding claim 37, Mieher discloses the method of claim 23, wherein the local process variations (said sampling parameter of film thickness) cause the at least two measurement locations (of three layers a shown in fig. 2a) in the overlay pattern (fig. 2a and 2b) to differ from each other (as clearly shown in fig. 2a that shows different film thicknesses due to a variable film thickness sampling parameter in [0090] and [0222]) with respect to at least one of film thickness (represented as said variable film thickness sampling parameter), grating height of the bottom diffraction grating and linewidth of the bottom diffraction grating.

Regarding claim 38, Mieher discloses the method of claim 24, wherein the incomplete overlay pattern includes the local process variations (as implied in fig. 2a that shows a completed overlay pattern at various thicknesses).

Claim 39 is rejected the same as claim 37. Thus, argument similar to that presented above for claim 37 is equally applicable to claim 39.

8. Claims 23 and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Stirton (US Patent 6,458,605 B1)

Regarding claim 23, Stirton discloses a method comprising:

a) providing an overlay pattern (fig. 3B, num. 200) having a plurality of measurement locations, each measurement location includes a bottom diffraction grating (fig. 3A,num. 202) and a top diffracting grating (fig. 3A,num. 204) that overlies the bottom diffraction grating and has a designed in offset (as indicated by the stager of numerals 212 and 210) from the bottom diffraction grating, wherein at least two measurement locations (or layers) in the overlay pattern differ from each other (due to the offset) at least partially due to local process variations (since the offset is a design parameter that shifts the layers) created during processing of the overlay pattern;

b) illuminating (fig. 3B, num. 132) each of the plurality of measurement locations of the overlay pattern with incident radiation that reacts with the diffraction gratings;

c) detecting (fig. 3B,num. 134) the radiation from the measurement locations after reacting with the diffraction gratings;

d) determining a measurement (via fig. 3B,num. 134) of an overlay error between the bottom diffraction gratings (fig. 3B, num. 208) and the top diffraction gratings (fig. 3B, num. 212) using the detected radiation (via arrows in fig. 3B) from the measurement locations (since said arrows bounce off of said gratings) from the overlay pattern (fig. 3B, num. 200); and

e) correcting the determined measurement of the overlay error (corresponding to "a reduction in the overlay error" in col. 11, lines 11-13) for effects of the local process variations (or implied combined "manufacturing process conditions" in col. 11, lines 3-11) created during processing of the overlay pattern using the detected radiation (said arrows) from at least one pair of the measurement locations (or layers in fig. 3B) from the overlay pattern.

Regarding claim 24, claim 24 is rejected the same as claim 23 except for the additional limitation as disclosed in Stirton of further comprising:

a) providing the overlay pattern (as indicated in fig. 3A) having the plurality of measurement locations prior to depositing the top diffraction gratings over the bottom diffraction gratings, such that the overlay pattern is incomplete and each measurement location of the incomplete overlay pattern has a bottom diffraction grating.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Imai (US Patent 6,737,207 B2) is pertinent as teaching a method of using a grating that is uneven or convex as shown in fig. 4C that corresponds to the claimed local process variation.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dennis Rosario whose telephone number is (571) 272-7397. The examiner can normally be reached on 9-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Dennis Rosario/
Examiner, Art Unit 2624

/Matthew C Bella/
Supervisory Patent Examiner, Art Unit 2624